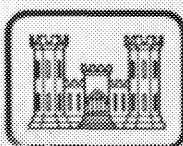


PAWCATUCK RIVER AND NARRAGANSETT BAY
DRAINAGE BASINS
WATER AND RELATED LAND RESOURCES STUDY

DRAFT

INTERIM REPORT
BIG RIVER RESERVOIR PROJECT
RHODE ISLAND

VOLUME VI
APPENDIX J — ECONOMICS
APPENDIX K — INSTITUTIONAL ANALYSIS



**United States Army
Corps of Engineers**

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JULY 1980

Pawcatuck River and Narragansett Bay Drainage Basins
Water and Related Land Resources Study

BIG RIVER RESERVOIR PROJECT

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Pawcatuck River and Narragansett Bay Drainage Basins

Water and Related Land Resources Study

BIG RIVER RESERVOIR PROJECT

DRAFT

APPENDIX J

ECONOMICS

Department of the Army
New England Division, Corps of Engineers
Waltham, Massachusetts

July 1980

APPENDIX J

ECONOMICS

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I. INTRODUCTION

This appendix contains details of the economic impacts, including project costs and benefits, associated with implementation of the proposed water supply alternatives for the 17 community study area in northern and central Rhode Island. These impacts will be discussed in the context of underlying baseline economic conditions, as well as conditions anticipated in the future if no Federal action is taken.

General economic criteria applied in the evaluation of alternatives include consideration of both National Economic Development and Regional Development. Plans to be considered economically justified must exhibit a ratio of benefits to costs greater than unity, i.e. resulting in a return of one dollar or more on each dollar invested. The scope of development selected from among the economically justified alternatives should be that which maximizes net benefits. The selected plan for National Economic Development must be the most economical means, evaluated on a comparable basis, of accomplishing the project purposes.

Indirect or secondary economic impacts of the proposed Big River Reservoir and other major alternatives are also included in this appendix. Short term and long term effects on employment, income, and commercial and industrial development are discussed in relation to proposed water supply improvements.

II. ALTERNATIVE PLANS AND THEIR ECONOMIC IMPACTS

Several alternative methods of dealing with the anticipated future water shortage in Rhode Island, particularly in the metropolitan Providence area, have been proposed and studied in detail over the past two decades. Consideration of several potential well field sites and surface reservoir locations culminated in the decision by the State of Rhode Island to purchase the site of the proposed Big River Reservoir as the most efficient, feasible solution to the problem.

Three alternative plans have been selected for detailed analysis including:

Plan A. Provides for a Demand Modification program to be implemented immediately throughout the study area, with a total water saving of 15 mg on an average day and 28 mg on a maximum day by 2030; development of ground water resources totaling .5 mgd in 1990 and .5 mgd in 2020 for Foster, and 1.0 mgd in 1990 and 1.0 mgd in 2010 for Glocester, development of local ground water sources (3.0 mgd immediately, 1.0 mgd in 1995, and 2.0 mgd in 2015) in Rehoboth, Massachusetts to serve Bristol County, Rhode Island; and development of Big River Reservoir to produce water by 1995,

which in combination with the Scituate Reservoir would provide a safe yield of about 113 mgd, considered sufficient to meet the average and maximum day demands projected by the year 2030. Big River Reservoir would be constructed as a multipurpose facility, with flood control and recreation features incorporated into the design. Measures for mitigating potential losses of cultural and natural resources are also included in the plan.

Plan B. Provides all development described in Plan A, with additional construction of environmental habitats, such as wetlands and waterfowl habitats. All roads except Division Street would be relocated.

Plan C. Similar to Plan A, except that it provides a more regional approach to supplying the entire study area. Local source development in Bristol County would not be as intensive as in Plans A and B. Instead, pipeline connections would be established between the Providence system and Bristol County Water Company, crossing the Providence and Warren Rivers from Cranston to Warren.

Each of these plans would be adequate to meet the water supply needs of the study area over the foreseeable future, and would lessen the threat of future flood damages and provide additional recreational opportunities for surrounding communities. Failure by the Federal Government, State government, or local governments to implement any of the proposals described above or any similar plan to provide additional sources of supply would result in actual shortages sometime between 1990 and 1995. The most probable future scenario would be the establishment of a new balance between supply and demand around the year 1990, at the time that demand first exceeds available supply. Institutional restraints on growth may become necessary to prevent any future increases in consumption. Since this new balance would occur at or near the supply capacity of existing sources, spot shortages would remain a problem during extended dry periods in subsequent years.

During periods of severe drought, business and industry may be forced to limit or cease operation to accord top priority to residential requirements. Lack of water or reduced water pressure for combating fires may result in increased damages and higher insurance rates. The area would become less attractive to new industries and commercial enterprises, and existing business may choose to relocate to avoid the uncertainty of potential financial losses resulting from restricted water use. Commercial and residential property values would decline as the general area develops a reputation as an undesirable place to live and work, particularly if rationing becomes necessary. Overall, the effects on employment and therefore on aggregate income would be adverse or negative, in an area which already compares unfavorably with national averages in unemployment.

The major beneficial economic impact associated with the improbable decision to provide no additional supply sources would be cost savings over actual reservoir development. Although the overall supply would be

adequate for the area as a whole until approximately 1990, negative economic effects would begin to appear shortly thereafter. It should also be recognized that spot shortages exist at the present time in Bristol County, with an additional 3.0 mgd needed immediately and a subsequent increase of 2.0 mgd required by 1995. Although surrounding communities enjoy excess supply at the present time, there is currently no physical means for Bristol County to tap that resource.

An analysis of economic impacts associated with implementation of proposed Plans A, B and C indicates that each plan seeks to fully address the water supply needs of the entire study to allow continued growth and prevent the negative impacts of no action for additional supply. Since the major feature of each plan is the construction of Big River Reservoir over 3,280 acres of inundated land, storing 24,000 mg (73,600 acre-ft.) of water for public supply, many of the economic impacts would be shared by all three plans. Impacts of providing 9,500 acre-feet of flood control storage and of including recreational features in all plans would also be identical among the three alternatives. Thus, general economic impacts can be discussed for all three as a group.

The non-structural element of the overall plans, demand modification, would involve the implementation of a multifaceted program designed to reduce water consumption through education of the public, installation of water saving devices, establishment of building code restrictions, and detection and repair of leaks. As currently proposed, the demand modification program would be initiated almost immediately with an ongoing effort to keep the public informed of the need for conservation and the methods by which significant savings can be realized, in addition to a continuing program of replacement of appliances and transmission facilities with water saving counterparts over time.

Anticipated water savings from the educational portion of this program would total approximately five percent of average daily demand by the study year 2020. An additional two percent savings could be expected through the same study period as a result of a leak detection and repair program preceded by a more extensive system of metering of all services and the estimation of unmeterable uses. The institution of building code restrictions which would require the use of water saving fixtures in new homes would reduce average daily demands in the study area by approximately two percent in 1995 and four percent in 2020.

Thus, the overall effect on the growth of demand from a comprehensive water demand modification program involving all of the above techniques is estimated at eleven percent reduction by 2020. These anticipated percentage savings were derived from a study conducted by Schoenfeld Associates, Inc., Engineers, Architects, and Planners under contract with the New England Division to determine the applicability of several demand modification programs implemented nationwide to the Big River Study Area.

Although demand modification would successfully forestall the need for additional water supply for several years, those conditions described

as a result of taking no action would eventuate. Demand modification, in itself, would not provide a solution to the water supply problem in the study area.

Many of the adverse economic impacts associated with a project of the magnitude of Big River were dealt with at the time the land was purchased by the State of Rhode Island in 1963. The impoundment area for the reservoir remains relatively undeveloped in a state which has little open space, and is currently underutilized for a mixture of residential, recreational, and a few commercial purposes. Approximately 110 tenants, for a total resident population of 440, are renting their residences in the Big River area from the state with the knowledge that relocation will be necessary when the planned development actually occurs. Housing for approximately 134 people included in this total population is concentrated in 79 mobile homes located in the Maple Root Trailer Park situated near the site of a proposed treatment facility.

The major commercial activity in the impoundment area that would be eliminated by the construction of the reservoir is the mining of sand and gravel in the vicinity of Division Road and Interstate Route 95. Three private contractors are currently removing one million cubic yards each under agreement with the state, a task that will not be completed until 1980 or 1981. It is estimated that over thirty million cubic yards of sand and gravel remain in the area, with a commercial value of \$1.00 to \$1.50 per cubic yard, depending on the texture and quality of the product at the pit. Total commercial value is therefore between \$30 million and \$45 million at the present time, and will be between \$27 million and \$40.5 million after the ongoing contracts are completed. These values attached to sand and gravel deposits are reflected in the estimated value of real estate in the impoundment area, and are therefore considered in the formal economic justification of the project.

It should be noted that the State of Rhode Island is currently preparing guidelines for a study to be conducted to determine whether or not it would be feasible to remove all or most of the sand and gravel prior to construction of a reservoir and stockpile it at a nearby site. Because the State owns the land on which the sand and gravel are located and recognizes that the resource is non-renewable, the upcoming study is expected to result in a management plan designed to mitigate the potential loss of the resource.

The economic value of the sand and gravel and the effects of eliminating its mining on the regional economy acquire increased significance when weighed against the predicted scarcity of sand and gravel for construction purposes in Southeastern New England and in particular, Rhode Island. Those contractors currently involved in excavation operations at the Big River site claim that this source provides the highest quality sand and gravel for the lowest cost possible in the state. Although none of the three contractors employ any workers solely to complete their contractual agreement with the state, several of their employees are involved in that operation at various times. While two of the three

contractors regard their excavations in the Big River area as a small portion of their overall operation, one claimed that his business was largely dependent on the contract to remain profitable. Alternative sources of sand and gravel exist but involve much greater transportation distances at greater expense. Transportation costs have been estimated at \$30 per hour per truckload of approximately 20 cubic yards. It is also estimated that one hour is required to complete a round trip delivery for each additional seven to eight mile distance from the source to the purchaser. These additional transportation costs are reflected in the price of sand and gravel in the local market, and therefore passed on to the construction industry.

Other commercial activities at the proposed reservoir site include the operation of a single drinking establishment in a building rented from the state and the harvesting of a small quantity of timber under agreement with a private contractor. Most of the vegetative cover is of a scrub variety, with little or no commercial value. Several sections of softwood sawtimber do exist and could be harvested before any proposed development occurs. Although the hardwood trees in the area are not generally large enough for sawtimber, they could be sold for other purposes such as pulp, poles, posts, and firewood.

One activity in the impoundment area with significant recreational and commercial value is golf. A nine-hole course is located along Harkney Hill Road in Coventry and would be completely eliminated by the construction of the reservoir. Usually open from mid-March to mid-December, the club employs five persons, full time and part time with a total payroll of approximately \$25,000. Although no figures for annual revenue generated are available, they can be estimated using the known green fees and utilization rates. On the average day, 150 to 175 golfers use the course for a fee of \$3.00 for nine holes or \$5.00 for eighteen holes. On Sundays, the peak day of use, up to 200 golfers are common. Thus, an average of 168 golfers per day for an average fee of \$4.00 use the course on approximately 260 days, resulting in a total gross revenue of \$181,440. This estimate could be considered minimal because it ignores the additional revenues obtained from equipment sales and rentals and the operation of a snack bar. Golf is the only recreational activity in the area for which a fee is required.

Other recreational activities common at the Big River site include boating, fishing, hiking, horseback riding, hunting, picnicking, and swimming. Current utilization of available recreational opportunities falls far short of the capacity that exists in the impoundment area, possibly due to lack of public knowledge of available opportunities, lack of parking facilities, or a preference for other better managed recreational sites in the local area. Thus, the inclusion of recreational development in Plans A, B and C should enhance the recreational value of the Big River site.

Since implementation of any of the proposed Federal Plans would ensure a surplus water supply throughout the fifty year planning period,

continued population growth and prevention of the loss of business and industry necessary to support an increased population would be expected. Property values would be protected against the threat of decline resulting from fear of insufficient supply to meet residential, commercial and industrial demand.

Economic benefits in addition to those already described could be expected throughout the entire study area. The types of industry attracted to the State of Rhode Island and the study area in particular at the present time are not considered major water users. The overall employment trends in the state indicate a growth in service industries and a gradual decline in manufacturing. However, the existence of coal deposits in southeastern Massachusetts and Rhode Island and possible oil deposits off the New England coast could conceivably lead to future development of refineries, which generally consume large quantities of water. While an adequate water supply would not ensure the location of these facilities in the study area, lack of water would preclude that possibility.

Temporary economic benefits could also be expected in the local area during the active construction period. A project of Big River Reservoir's magnitude would require a moderate construction work force over a four-year period and may result in some permanent and temporary relocations to the surrounding area. Employment benefits would accrue to the entire State of Rhode Island, where the unemployment problem is typically significantly more severe than the national average, and particularly to those towns adjacent to the impoundment area, including West Greenwich, Coventry, East Greenwich, and Exeter. Increased employment in the area may have an especially beneficial impact on nearby North Kingstown, where many employment opportunities were lost as a result of the closing of military installations located there. Increased aggregate income consequent to increased employment could also be expected. Additional population, including temporary residents, should increase the viability of commercial enterprises and lodgings in the vicinity of the project, stimulating even greater income growth.

Negative economic impacts associated with the construction of Big River Reservoir may also result. If population in the local area increased significantly, greater municipal expenditures for the extension of services may be required, only partially offset by the broadening of the tax base. A large number of new families with children might force the establishment of a school system in West Greenwich, which currently educates its elementary students in the West Greenwich - Exeter regional school system and transports its high school students to North Kingstown High School. An increased population may also necessitate the enlargement of the two-member police force and the establishment of a fire department, which is strictly volunteer at the present time. Obviously, these expanded services would require collection of additional property tax revenues. Whether or not large numbers of permanent relocations occur would depend on the size of the work crew over the estimated four-year construction period.

III. Costs of Alternative Plans

Preliminary cost estimates have been prepared for each of the alternative plans described. Implementation of all three plans would be phased over a period of 35 years beginning with the immediate implementation of a demand modification program and the local development of ground water. Estimated expenditures for each of the three plans are displayed by the year in which actual expenditures are anticipated in Tables 1 through 3, calculated at January 1979 price levels. These same cost estimates are expressed in present worth dollars in Table 4 for all three plans, reflecting differences in real dollar values resulting from phased implementation. All calculations were made at an interest rate of 7-3/8 percent for a 100-year project life. Interest during construction would accrue only during the development of the Big River Reservoir component of the overall plans, an anticipated period of four years. Annual costs based on these present worth construction estimates are shown in Table 5.

Cost estimates displayed in these Tables and in Appendix G, entitled Design and Cost Estimates, have been updated to June 1980 price levels to correspond with the 1980 base year for project benefits, a necessary step for formal comparison of annual costs and benefits in the economic justification of proposals. These updated estimates are displayed in Table 6.

Table 1

ESTIMATED CONSTRUCTION COSTS FOR PHASED IMPLEMENTATION OF PLAN A THOUSANDS OF DOLLARS

CAPITAL COST	1980	1990	1995	2005	2010	2015
Ground water	2,147	2,527	393		325	188
Big River Reservoir						
Development			16,033			
84" Tunnel			16,488			
55 mgd WTP			27,550			
55 mgd STP			1,950			
Recreation			430	121		
Cultural Mitgation			390			
Natural Resource Mitigation			550			
Contingencies	429	506	12,757	24	65	38
Engineering and Design	412	495	9,209	26	74	43
Supervision and Administration	258	304	6,321	19	43	25
Real Estate	70	47	31,560		47	24
Demand Modification	100					
Total	3,416	3,879	123,631	190	554	318

Table 2

ESTIMATED CONSTRUCTION COSTS FOR PHASED IMPLEMENTATION OF PLAN B
THOUSANDS OF DOLLARS

CAPITAL COST	1980	1990	1995	2005	2010	2015
Ground water	2,147	2,527	393		325	188
Big River Reservoir						
Development			27,374			
84" Tunnel			16,488			
55 mgd WTP			27,550			
55 mgd STP			1,950			
Recreation			430	121		
Cultural Mitgation			390			
Natural Resource Mitigation			2,411			
Contingencies	429	506	15,398	24	63	38
Engineering and Design	412	495	11,110	26	74	43
Supervision and Administration	258	304	6,748	19	43	25
Real Estate	70	47	31,560		47	24
Demand Modification	100					
Total	3,416	3,879	141,802	190	554	318

Table 3

ESTIMATED CONSTRUCTION COSTS FOR PHASED IMPLEMENTATION OF PLAN C
THOUSANDS OF DOLLARS

CAPITAL COST	1980	1990	1995	2005	2010
Ground water	1,949	2,527			325
Big River Reservoir					
Development			16,033		
84" Tunnel			16,488		
60 mgd WTP			29,270		
60 mgd STP			2,070		
Recreation			430	121	
Cultural Mitgation			390		
Natural Resource Mitigation			550		
Transmission			6,403		
Contingencies	390	506	14,327	24	65
Engineering and Design	374	495	10,316	26	74
Supervision and Administration	234	304	6,492	19	43
Real Estate	70	47	31,514		47
Demand Modification	100				
Total	3,117	3,879	134,283	190	554

Table 4

PRESENT WORTHED VALUES OF CONSTRUCTION COSTS
JANUARY 1979 PRICE LEVELS

	<u>PLAN A</u>	<u>PLAN B</u>	<u>PLAN C</u>
	<i>132</i>	<i>150</i>	<i>142</i>
Total First Cost	\$47,963,215	\$54,212,585	\$51,301,297
Interest During Construction	6,271,578	7,193,360	6,811,935
Total Investment	\$54,234,793	\$61,405,945	\$58,113,232

Table 5

ANNUAL COSTS; JANUARY 1979 PRICE LEVELS

	<u>PLAN A</u>	<u>PLAN B</u>	<u>PLAN C</u>
Interest and Amortization	\$4,003,070	\$4,532,373	\$4,289,338
Operation and Maintenance	831,148	831,148	889,900
Major Replacements	43,075	43,075	45,537
Total Annual Cost	\$4,877,293	\$5,406,596	\$5,224,775

Table 6

UPDATED CONSTRUCTION COSTS AND ANNUAL COSTS
JUNE 1980 PRICE LEVELS

	<u>PLAN A</u>	<u>PLAN B</u>	<u>PLAN C</u>
Total Investment	\$62,370,263	\$70,616,837	\$66,830,217
Interest and Amortization	\$4,602,907	\$5,211,523	\$4,932,000
Operation and Maintenance	955,820	955,820	1,023,385
Major Replacements	49,536	49,536	52,368
Total Annual Cost	\$5,608,263	\$6,216,879	\$6,007,823

IV. BENEFITS AND ECONOMIC JUSTIFICATION

Benefits from municipal water supply storage result from improvements in conditions of water use, largely in regard to quantity and dependability, quality, and physical convenience. In basic concept, the limiting values of such improvements are the maximum amounts prudent users would be willing to pay for the water supply storage components of municipal water supplies, assuming that decision would be made on the basis of a broad public viewpoint rather than a regional or local viewpoint. Because maximum willingness to pay is difficult to ascertain, it is often impossible to quantify benefits in this manner. It would appear to be a reasonable assumption, however, that people's willingness to pay is reflected by existing market rates.

Another approach to computing benefits accruable to water supply storage involves comparison with alternative costs, i.e. the cost of the most likely alternative in the absence of Federal involvement, assuming equal quantity and quality of water produced. In the case of Big River Reservoir, however, it is difficult to determine exactly what course of action that the State of Rhode Island, local governments, or private water authorities would take if the Federal Government failed to implement a plan for development of additional water resources. The clearest indication is that the State would eventually respond on its own to implement a single purpose water supply reservoir similar in nature to Big River Reservoir, with a minimal expenditure on mitigation measures. Although Rhode Island is not officially committed to such development, it appears to be the most reasonable future scenario due to the enthusiastic support for the project at the State Government level, the fact that the State has already purchased the land, and because of ongoing studies by the State as to how the construction of the Reservoir could be accomplished in the absence of Federal participation. Thus, benefits for Big River Reservoir could be at least partially based on the cost of this "most likely alternative," the construction of a reservoir on the Big River site by the State of Rhode Island. Local ground water resources would also be likely to be developed by State or local interests if no Federal action is forthcoming.

In the event that no most likely alternative can be established, Corps regulations suggest that an average unit cost of raw water from recently constructed or planned projects in the general region providing comparable units of dependable yield be utilized. Once again, difficulties are encountered in attempting to apply this methodology directly to the Big River Reservoir Study because no other projects of similar magnitude have been planned or constructed in the area for several decades.

A unit value for water obtained from a proposed new surface source could be established by considering the current selling price of raw water from existing sources of supply in the study area. Since water rates are set at a level necessary to at least recover the cost of the investment, the selling price is also somewhat reflective of the cost of development of the source. The Big River study area is primarily dependent upon the Scituate Reservoir to meet its present water supply needs, supplemented by local ground water development. Since the Scituate Reservoir was completed in 1926, when construction costs and interest rates were much lower, the total investment to be repaid through revenue returned through the marketing of water is also much lower than for the proposed Big River Reservoir. Thus, utilizing a unit value for water in the region based on costs associated with existing surface supply sources will conservatively bias the resulting benefit.

Attaching a unit value to a surface water supply also presents problems due to the variation in existing rates among different regions of the study area. Established rates also reflect differing amounts of pumping and treatment required, depending on geographic locations and source of supply.

In the case of proposed new ground water sources, a uniform estimate of unit value for raw water throughout the study area is readily available. The average cost of water at four major wells operated by the Kent County Water Authority at an elevation of 242 ft. above sea level, reflecting the original investment and pumping, but no treatment costs, is \$489.00 per million gallons. The actual cost of producing and delivering well water can be significantly greater when the well is located closer to sea level and gravity flow is not sufficient to supply the area of demand.

Thus, a reasonable approach to quantifying water supply benefits for the specific alternatives proposed in this report would be based on a combination of the principles underlying all three of the methodologies described. Benefits for the surface water provided by Big River Reservoir would be computed on the basis of comparable cost of a similar, likely alternative project undertaken in the absence of Federal involvement while benefits for ground water would be determined through the use of an average unit value in the study area of \$489.00 per million gallons. Since the total benefit for increased water supply for Plan A would be identical to that of the most likely alternative water supply development, that benefit is also attributed to Plans B and C.

It should also be noted that benefits would be expected to accrue to each of the three proposed Federal plans due to the demand modification component included in each. Whether or not a demand modification program would precede or be included as part of an overall water supply management plan implemented by a non-Federal authority is difficult to ascertain due to the fact that it would not be required as it is in the Federal planning process. Therefore, any reduction in demand for water must be quantified and treated as an economic benefit to all three Federal plans. For purposes of this report, it would appear reasonable to assign a value to water conserved based on the average unit value obtained for ground water.

The first proposed alternative to be considered, identified as Plan A, would provide for: a demand modification program resulting in a total annual water savings of 15 mgd on an average day and 28 mgd on the maximum day by 2030; construction of Big River Reservoir with a total storage capacity of 24,000 mg and a total safe yield of 36 mgd; development of ground water resources at various locations, primarily for use by Bristol County, with a total safe yield of 9.0 mgd for the study area. The major element of Plan A, Big River Reservoir, would also result in the accrual of benefits for flood control and recreation.

As stated previously, benefits anticipated as a result of implementation of a demand modification program should be based on the unit value of raw water in the study area, best reflected by the current average unit cost of ground water. Implementation of the proposed demand modification program would begin immediately and produce benefits in the form of water savings expected to grow at a uniform rate until 2030, peaking at 15 mgd and remaining constant thereafter (see Figure J-1). Benefits are therefore calculated as follows:

15 mgd x \$490.00/mg x 365 days = annual savings

\$2,682,750 = annual savings

Average Annual Equivalent Benefit (100 year project life, 50 years
of uniform benefit growth @ 7-3/8% interest) = \$757,000

The additional ground water development, totaling 9.0 mgd, would occur in stages between the present, 1980, and 2015, as described under Plan Description in Appendix B, Plan Formulation. For the study area as a whole, Plan A calls for development of 3.0 mgd of additional ground water in 1980, 1.5 mgd in 1990, 2.0 mgd in 1995, 1.5 mgd in 2010, and 1.0 mgd in 2015 (see Figure J-2). It has been assumed in this report that this same level of ground water development would occur even in the absence of Federal action. Since the resulting unit value for ground water is applicable to the most likely alternative, it can also be attributed to Plans B and C. Using the average unit value of ground water in the study area, annual benefits are calculated as follows:

1980	3 mgd x \$490/mg x 365 days = \$536,550
1990	4.5 mgd x \$490/mg x 365 days = \$804,825
1995	6.5 mgd x \$490/mg x 365 days = \$1,162,529
2010	8 mgd x \$490/mg x 365 days = \$1,430,800
2015	9 mgd x \$490/mg x 365 days = \$1,609,650

Average Annual Equivalent Benefit: \$965,000

The major benefit anticipated through the implementation of all three plans would result from the additional surface water supplied through construction of Big River Reservoir, with an expected completion date of 1995. As stated previously, benefits for Big River Reservoir are based on the cost of the most likely alternative in the absence of Federal involvement. Due to the fact that the State of Rhode Island has already acquired the land for construction of a water supply reservoir on Big River and the need for such a facility has been established at the State level, it seems most probable that in the absence of Federal action, Big River Reservoir would be constructed over approximately the same time frame as the Federal proposal, ready for use by 1995. The non-Federal Big River Reservoir would be of similar dimensions and yield as the proposed Federal reservoir, but would be designed as a single purpose facility, eliminating flood control and recreation, with only minimal mitigation measures associated. Estimated first costs for construction and annual costs of the non-Federal alternative are displayed in Table 7. All costs displayed are at January 1979 price levels, present worth from 1995.

Table 7
First Cost and Annual Cost of Non-Federal, Single
Purpose Alternative Reservoir at Big River Site
 (1979 Price Levels)

Construction Costs:	
Relocations	\$1,108,000
Reservoir Clearing	674,000
Dam Embankment	665,000
Impervious Cutoff	1,135,000
Outlet Works	448,000
Spillway	930,000
Roads	12,000
Buildings, etc.	52,000
Equipment, etc.	34,000
Raw Water Main	294,000
84" Tunnel	5,670,000
55 mgd Water Treatment Plant	9,475,000
55 mgd Sludge Treatment Plant	671,000
Total Reservoir	<u>21,168,000</u>
Mitigation	
Natural Resources	189,000
Cultural Resources	<u>134,000</u>
Sub-total	21,481,000
Contingencies (20%)	4,298,000
Engineering and Design (12%)	3,095,000
Supervision and Administration (8%)	2,063,000
Real Estate	<u>10,838,000</u>
Total Project First Cost	41,785,000
Interest During Construction	<u>6,163,000</u>
Total Investment	<u>\$47,948,000</u>
Annual Costs:	
Interest and Amortization (100 yrs. @ 7-3/8%)	\$3,539,000
Operations and Maintenance	713,000
Major Replacements	<u>40,000</u>
Total Annual Cost	<u>\$4,292,000</u>

For purposes of the economic analysis, these cost estimates are further updated to September, 1980 levels to correspond with the 1980 base year selected for discussion of all other project benefits. These 1980 values are displayed in Table 8. Annual benefits expected to accrue to all three Plans, A, B and C, for Federal construction of Big River Reservoir are therefore equal to total annual cost expressed at 1980 price levels, \$4,963,000.

Table 8
Updated First Cost and Annual Cost of Non-Federal, Single Purpose
Alternative Reservoir at Big River Site
 June 1980 Price Levels

Total Investment	\$55,140,000
Annual Costs:	
Interest and Amortization (100 yrs @ 7-3/8%)	\$4,070,000
Operations and Maintenance	820,000
Major Replacements	46,000
Total Annual Cost	<u>\$4,936,000</u>

Additional benefits expected to accrue to all three reservoir plans through provision of recreational facilities, as described in Appendix H, Recreation and Natural Resources, total \$22,000. The derivation of this total is shown in Figure J-3. Benefits will begin to accrue immediately upon completion of the reservoir, and will grow with increased utilization of facilities until 2020, after which it is expected to remain constant throughout the period of analysis.

Flood control benefits for all three Federal plans are derived in the interim report issued in July 1980 by the New England Division, entitled Pawcatuck River and Narragansett Bay Drainage Basins, Water and Related Land Resources Study; Big River Reservoir Project, Rhode Island, Attachment 1 to this report. Benefits for damages prevented to existing structures and expected growth from 1972 to 1990 (much of which has already occurred) are identified in the report as \$782,200 at average 1979 price levels (see Table 7-6, Summary of Average Annual Benefits for the Selected Plan). Since the time these benefits were developed, the expected completion date for a Big River project has been changed from 1990 to 1995. Thus, the base year for benefits has been changed to 1995 to correspond with the date that the project will actually become functional. If the total anticipated benefit of \$782,200 is updated from average 1979 price levels to June 1980 price levels and discounted to a 1980 base year to correspond with all other project benefits, a total value of \$289,000 to be used in the economic justification of the project results.

All benefits expected to accrue to Plans A, B and C are listed in Table 9. Benefit-cost ratio and net benefits are displayed in Table 10.

Table 9
Annual Benefits

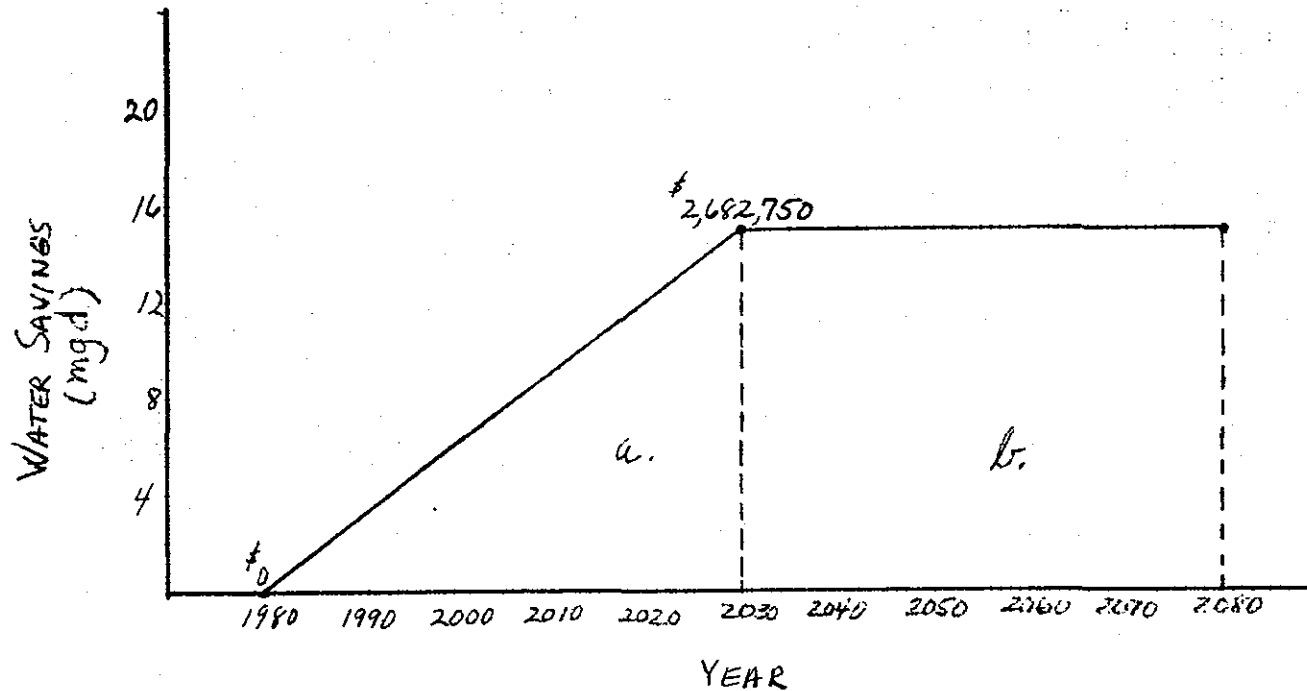
<u>Plans A, B and C</u>	
Demand Modification	\$757,000
Ground Water	\$965,000
Surface Water	4,936,000
Recreation	22,000
Flood Control	289,000
Total Annual Benefits	<u>\$6,969,000</u>

Table 10
Economic Justification

	Benefit-Cost Ratio	Net Benefits
Plan A	$\frac{\$6,969,000}{\$5,608,000} = 1.24$	$\$6,969,000 - \$5,608,000 = \$1,361,000$
Plan B	$\frac{\$6,969,000}{\$6,217,000} = 1.12$	$\$6,969,000 - \$6,217,000 = \$752,000$
Plan C	$\frac{\$6,969,000}{\$6,008,000} = 1.16$	$\$6,969,000 - \$6,008,000 = \$961,000$

As indicated by Table 10, all three Federal plans are justified on the basis of an expected return of greater than one dollar on every dollar invested. Since Plan A maximizes net economic benefits it is designated as the National Economic Development Plan. It should be noted, however, that many of the benefits attributable to Plan B are nonquantifiable but are of significance due to enhancement of the environment, and that while Plan C would not provide a larger capacity of surface water, it would benefit Bristol County by allowing it to draw from the Big River Supply. Selection of a recommended plan must therefore result from a trade-off of all economic, environmental, and technical positive and negative aspects of each plan.

FIGURE J-1
DERIVATION OF DEMAND MODIFICATION BENEFIT



$$15 \text{ mgd.} \times \$490/\text{mg} \times 365 \text{ days} = \text{annual savings (2030)}$$

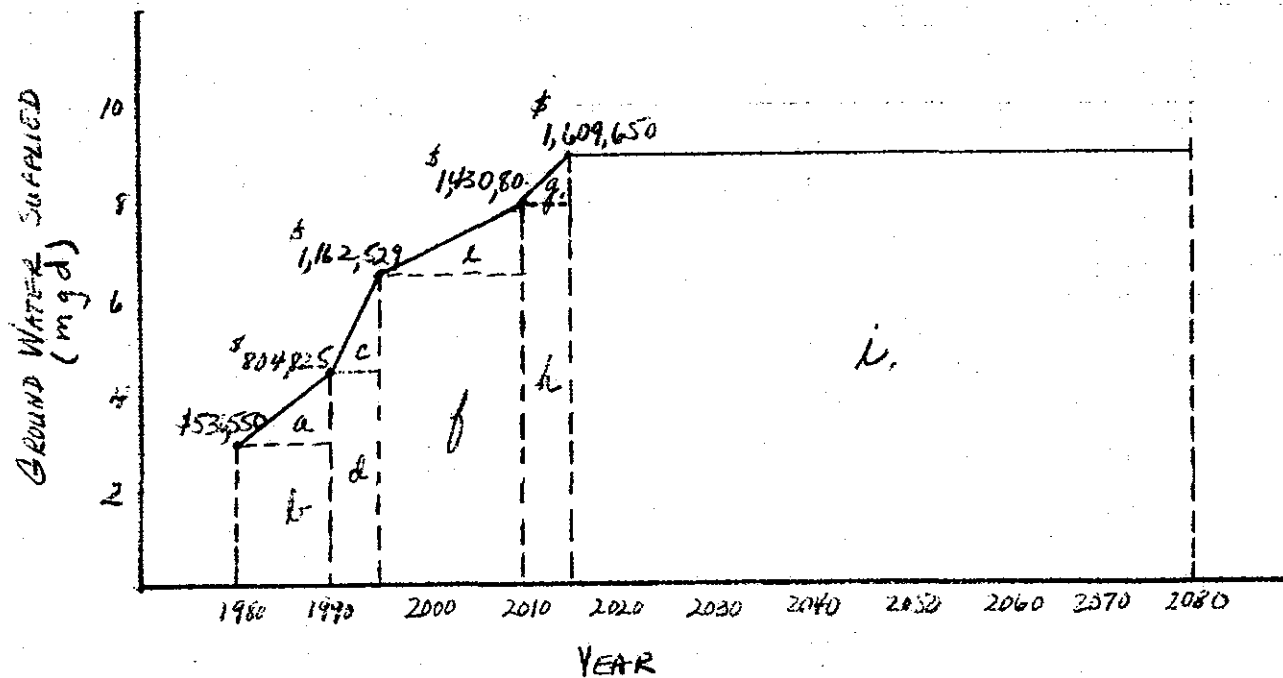
$$\$2,682,750 = \text{annual savings (2030)}$$

average annual equivalency factor = .28230
 (50 year uniform growth period, 100 year project
 life, $7\frac{3}{8}\%$ interest.)

$$\$2,682,750 \times .28230 = \$757,340$$

Average Annual Equivalent Benefit = \$757,000

FIGURE J-2
DERIVATION OF GROUND WATER BENEFIT
PLANS A, B, and C



AVERAGE ANNUAL EQUIVALENT BENEFIT = \$965,000

1980: $3 \text{ mgd} \times \$490/\text{mg} \times 365 \text{ days} = \$536,550$
1990: $4.5 \text{ mgd} \times \$490/\text{mg} \times 365 \text{ days} = \$804,825$
1995: $6.5 \text{ mgd} \times \$490/\text{mg} \times 365 \text{ days} = \$1,162,529$
2010: $8 \text{ mgd} \times \$490/\text{mg} \times 365 \text{ days} = \$1,430,800$
2015: $9 \text{ mgd} \times \$490/\text{mg} \times 365 \text{ days} = \$1,604,650$

FIGURE J-2 (CONT.)

$$a) \$804,825 - \$536,550 = \$268,275$$

$$\frac{\$268,275}{10 \text{ yrs.}} = \$26,828/\text{yr.} = \text{Average Annual Increase}$$

6.9034 = Present Worth of 1 per period for 10 periods @ 7 $\frac{3}{8}$ %

$$6.9034 \times 10 = 69.0340$$

Where 10 = # of yrs. growth period

35.8840 = Σ Present Worths of 1 per period for n-1 (=9) periods

$$69.0340 - 35.8840 = 33.9500$$

$$\$26,828/\text{yr.} \times 33.95 \times .07380 = \$67,218$$

Where .07380 = Interest and Amortization factor for 100 yrs @ 7 $\frac{3}{8}$ % interest.

$$b) \$526,530 \times 6.9034 \times .07380 = \$273,357$$

$$c) \$1,162,529 - \$804,825 = \$357,704$$

$$\frac{\$357,704}{5 \text{ yrs.}} = \$71,541/\text{yr.} = \text{Average Annual Increase}$$

4.0594 = Present worth of 1 per period for 5 periods @ 7 $\frac{3}{8}$ %

$$4.0594 \times 5 = 20.2968$$

Where 5 = # yrs. growth period.

8.6951 = Σ Present Worths of 1 per period for n-1 (=4) periods.

$$20.2968 - 8.6951 = 11.6017$$

$$\$71,541 \times 11.6017 \times .07380 \times .49087 = \$30,068$$

Where .49087 = PW of a lump sum for 10 yrs. (1990-1980)

$$d) \$804,825 \times 4.0594 \times .07380 \times .49087 = \$118,353$$

FIGURE J-2 (cont.)

$$v.) \$1,430,800 - \$1,162,529 = \$268,271$$

$$\frac{\$268,271}{15 \text{ yrs.}} = \$17,885 = \text{Average Annual Increase}$$

8.8961 = Present Worth of 1 per period for 15 periods @ 7 7/8%

$$8.8961 \times 15 = 133.4408$$

Where 15 = # yrs. growth period

73.8692 = Σ Present Worths of 1 per period for n-1 (=14) periods.

$$133.4408 - 73.8692 = 59.5716$$

$$\$17,885 \times 59.5716 \times .07380 \times .34391 = \$27,043$$

Where .34391 = Present Worth of a Lump Sum for 15 years.
(1995-1980)

$$f.) \$1,162,529 \times 8.8961 \times .07380 \times .34391 = \$262,484$$

$$g.) \$1,609,650 - \$1,430,800 = \$178,850$$

$$\frac{\$178,850}{5 \text{ yrs.}} = \$35,770/\text{yr} = \text{Average Annual Increase}$$

$$4.0594 \times 5 = 20.2968$$

$$20.2698 - 8.6451 = 11.6017$$

$$\$35,770 \times 11.6017 \times .07380 \times .11827 = \$3,622$$

Where .11827 = Present Worth of Lump Sum for
30 yrs. (2010-1980)

$$h.) \$1,430,800 \times 4.0594 \times .07380 \times .11827 = \$50,695$$

$$i.) \$1,609,650 \times 13.4264 \times .07380 \times .08286 = \$132,139$$

Where 13.4264 = Present Worth 1 per period, 65 periods.
.08286 = Present Worth Lump Sum for 25 yrs.
(2015-1980)

Summation:

$$\$67,218 + \$223,357 + \$30,068 + \$118,353 + \$27,043 + \$262,484 + \$3,622 + \$50,695 + \$132,139$$

$$= \$964,975$$

Say \$965,000

FIGURE J-3
DERIVATION OF RECREATIONAL BENEFIT

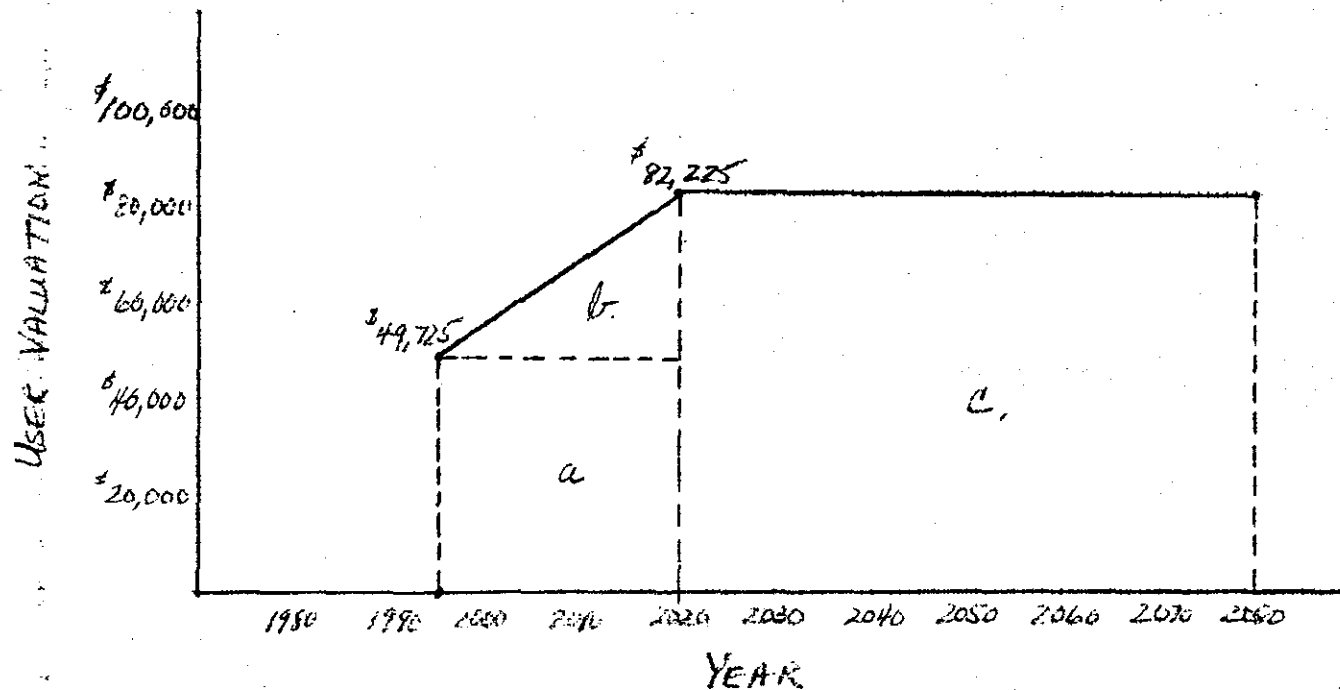


FIGURE J-3. (cont.)

a) $\$49,725 \times 11.2703 \times .07380 \times .34391 = \$14,224$

Where: 11.2703 = Present Worth of 1 per period for 25 Periods at $7\frac{3}{8}\%$ interest

.07380 = Interest and Amortization factor for 100 years at $7\frac{3}{8}\%$.

.34391 = Present worth of 1, 15 periods at $7\frac{3}{8}\%$.

b) $\$82,225 - \$49,725 = \$32,500$

$\frac{\$32,500}{25 \text{ yrs.}} = \$1,300 = \text{Average annual increase.}$

$11.2703 \times 25 \text{ yrs.} = 281.7575$

$174.8957 = \sum \text{Present worths of 1 per period, } n-1 (=24) \text{ periods.}$

$281.7575 - 174.8957 = 106.8618$

$\$1,300 \times 106.8618 \times .07380 \times .34391 = \$3,526$

c) $\$82,225 \times 13.36963 \times .07380 \times .05806 = \$4,710$

Where: 13.36963 = Present Worth of 1 per period for 60 periods at $7\frac{3}{8}\%$ interest

.05806 = Present worth of 1, 40 periods at $7\frac{3}{8}\%$

Summation:

$\$14,224 + \$3,526 + \$4,710 = \$22,460$
Say $\$22,000$

Pawcatuck River and Narragansett Bay Drainage Basins
Water and Related Land Resources Study

BIG RIVER RESERVOIR PROJECT

DRAFT

APPENDIX K

INSTITUTIONAL ANALYSIS

Department of the Army
New England Division, Corps of Engineers
Waltham, Massachusetts

July 1980

APPENDIX K

INSTITUTIONAL ANALYSIS

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I. EXISTING INSTITUTIONAL ARRANGEMENTS

A number of local, State and Federal agencies possess various powers related to the provision and protection of water and related land resources in the study area.

A. Local Agencies

1. Organization and Powers

Local agencies with water supply functions are, for the most part, the locally-managed suppliers who hold the primary responsibility for the development, operation and protection of water supply systems.

In Rhode Island these local water systems usually assume one of the following three organizational structures.

a. Municipal Departments. Cities and towns in Rhode Island may create and operate municipal water departments. Most municipal water departments have been established by special legislation, defining their service areas, management, structure and powers.

Municipal water departments are, in most communities, managed by an elected board of water commissioners, although in a few communities the water department is run by the Board of Selectmen or the Mayor through appointed public works officials. Day to day operation of municipal systems is managed by an appointed superintendent.

Once established, these departments operate under home rule and may be altered by the decision of the municipality. Municipal departments possess the following general powers:

- . acquire by eminent domain, or by lease or purchase, all water and lands located within the municipality needed to develop and protect water supply sources.
- . to construct water supply facilities.
- . to set reasonable rates.
- . to make assessments against property owners for capital improvements.
- . to issue bonds for capital expenditures upon approval of the electorate.
- . to sue and be sued.
- . to set rules and regulations for the management and operation of its system.

- . to make intermunicipal agreements with other water systems to supply and receive water.

Under special enabling acts, communities may, subject to approval and the holding of a hearing, take by eminent domain or acquire by purchase, lands outside the community needed to protect a watershed or collect and store water. Also, a board of water commissioners may, after a formal declaration of emergency, "restrain the use of water." This "restraint" may range from a public appeal to voluntarily limit the use of water for certain purposes to an absolute ban on new construction.

b. Water Districts. Water districts are public agencies created to provide water supply services to a legally defined area. This area may consist of a portion of a town or towns, or it may encompass entirely one or more towns.

Districts are usually administered by a board of water commissioners elected by users within the district and operated by an appointed water superintendent. Districts usually possess the same powers as a municipal water department; they differ from departments only in their right to borrow money.

c. Water Companies. Private water companies are defined as: every person, partnership, association, or corporation, other than a municipal corporation, or landlord supplying water to his tenant, engaged in the distribution and sale of water in the State and occupying public streets with its pipes and mains. Water companies are organized and operated as private, profit-making businesses and must pay taxes on their property holdings. They are under the immediate supervision of the Public Utilities Commission, which is primarily interested in capitalization, rate structures, and franchise territories. Any water company or corporation having franchise rights encompassing an entire municipality or district may, subject to State approval, take by eminent domain or acquire by purchase, all waters and lands needed to develop and protect water supply sources.

In Rhode Island, local supplies consist of 16 municipal departments, 7 water districts, and 2 water companies. These local supplies are subject to the requirement that all new supply sources receive Department of Health approval. It is also required that all new supply sources and distribution systems must be reviewed and approved by the State's Water Resources Board for compliance with the State's water resources development plan.

Of the 39 communities in Rhode Island, only 3 communities have municipal water departments that serve their entire community only. The remaining communities are served by combinations of water districts, large municipal departments with intermunicipal agreements and regional supply systems.

2. Operations

All water suppliers in the study area are single purpose entities. To meet the cash requirements of providing services, two methods are employed -- the wholesale or retail approach. The wholesale approach is used by water systems serving more than one community or district, and it entails the billing of each individual community or district connected with the system for its share. The retail approach involves billing each individual user.

3. Finance

a. Local Financing

(1) Major construction projects. At a local level, public water agencies may obtain funds for major construction projects using the following financing mechanisms:

(a) general obligation bonds - Municipal water departments and districts may issue general obligation bonds which are backed by the full fiscal resources of the community, including property taxes. Repayment of these bonds is guaranteed by taxes levied on all real property. These bonds have low interest rates due to their low risk and are easily marketable due to their standardized marketing procedure. To issue general obligation bonds, an agency must have the power to levy taxes. Issuance usually requires prior approval by qualified voters in an election.

(b) revenue bonds - Revenue bonds may also be used to finance major construction projects. Money for their repayment is raised from charges levied for services performed by the issuing unit. They are often used by revenue producing agencies and are quite popular because:

- . legal limits do not exist.
- . many agencies do not have the power to tax.
- . voter approval isn't necessary.
- . they can be used to finance projects extending beyond municipal boundaries.

These bonds have higher interest rates, but they are usually accepted as par with general obligation bonds in terms of risk.

(c) special assessment bonds - Special assessment bonds may also be used to finance project. Repayment of these bonds is accomplished through special assessments against benefited property owners. Their interest rates and finance charge is higher than other bonding methods. They are often issued in connection with general obligation bonds. In such cases, construction of facilities which benefit the general community are funded by general obligation bonds and laterals, mains, and submains, which abut and service properties, are funded by special assessment bonds. Special assessment bonds are usually short term, thus reducing the long term debt of the community.

(2) Cash requirements. Revenues are needed to enable an agency to meet the cash requirements of operation and maintenance, annual debt service, and repairs. These revenues are usually obtained through service charges, installation charges, and general taxation. As previously mentioned, there are two common approaches to billing for services rendered: the wholesale approach and the retail approach. Users are usually billed according to water consumption. Most water systems charge a flat fee for a minimum level of water use. However, billing practices for use over the minimum level vary among different water systems. Some systems charge a constant rate for all units of water used above the minimum level. Other systems employ a sliding scale for increased water -- as the water use increases, the cost of units of water decreases.

All excess revenue from the operation of municipal water departments go to a community's general fund and the funds used by the department come directly out of the general fund. Thus, a water department cannot apply its income towards improvements as private water companies and districts do. Although most municipal water departments prepare their own budgets, the budget must be approved by town meeting members or a city council.

b. Federal Financing. Federal assistance is available, in some cases for the financing of major construction projects.

(1) Economic Development Administration (EDA) grants. The Economic Development Administration, an agency of the Department of Commerce, provides funding in the field of water supply. EDA will contribute as much as 80 percent to the cost of local public works in towns where the economy is depressed, and it "can be shown that the project tends to improve the opportunities for the successful establishment or expansion of industrial or commercial plants or otherwise assist in the creation of additional long-term employment opportunities."

(2) Farmer's Home Administration (FHA) funding. The FHA makes loans and grants to public bodies and non-profit organizations for the construction of rural and community water and waste disposal systems. Under this program grants up to 50 percent of the construction of water facilities may be made. Eligible projects must serve residents living in open country or in rural towns with a maximum population of 10,000.

(3) Housing and Urban Development (HUD) grants. Under the Housing and Community Development Act of 1974, the Department of Housing and Urban Development may make block grants to communities for improvements. These grants may be applied to water department expenses and water facility construction costs.

(4) Programs of the U.S. Army Corps of Engineers, the U.S. Bureau of Reclamation, and Soil Conservation Service (SCS). The Army Corps of Engineers and the Bureau of Reclamation, under the Water Supply Act of 1958, and the SCS, under Public Law 566, may provide for additional capacity for other purposes. The Army Corps of Engineers and the Bureau of Reclamation require the non-Federal interests to pay costs allocable to the provision of such water at Federally subsidized interest rates. The SCS required such repayment up until the passage of the Rural Development Act of 1972, which authorizes the Secretary of Agriculture to bear up to one-half the costs of reservoir storage capacity for present municipal and industrial water supply needs.

B. Regional Agencies

1. Regional Water Suppliers

Rhode Island contains regional water systems created by special acts of the legislature which provide water supply services on an areawide basis. Membership in these systems is mandatory in some cases and discretionary in others. In general, the regional supplier is responsible for the development, operation and maintenance of the water supply source and related facilities, while the community or districts supplied are responsible for the distribution to the individual consumer. A description of some of the regional suppliers in the study area is provided below.

a. Kent County Water Authority

(1) Organization. Rhode Island's Kent County Water Authority is a political subdivision whose boundaries are coterminous with the boundaries of Kent County. It is administered by the board consisting of five members (four members appointed by the town or city councils of the four municipalities within the county, and one member appointed by the council of the town or city with the greatest number of inhabitants). It currently serves parts of two communities outside Kent County through contractual arrangements.

(2) Powers. As stated in its enabling legislation, the Kent County Water Authority has the following major powers:

- . to produce, distribute, and sell water within or out of the limits of the district.
- . to acquire by purchase, own, operate, maintain, sell, lease, or otherwise dispose of property involved in the provision and protection of water supply.
- . to fix rates and collect charges.
- . to make by-laws for management.
- . to issue bonds.
- . to sue and be sued.
- . to enter into cooperative agreements with cities, counties, towns or water companies for inter-connection of facilities.

(3) Operations. The Authority supplies water on a retail basis to towns within the district and on a wholesale basis to towns outside the district.

(4) Financing. Major construction projects are financed by the issuance of revenue bonds. Operations and maintenance costs are met through water usage charges.

b. The Providence Water Supply Board.

(1) Organization. The Providence Water Supply Board, the largest water system in Rhode Island is managed by a board of water commissioners consisting of a finance director, ex officio, and six other members, four of whom are appointed by the Mayor subject to the approval of the city council, and two of whom are members of the city council.

(2) Powers. The Act establishing the Board authorizes it to acquire by purchase or eminent domain all waters, lands, and flowage rights within a specified area of the watershed of the North Branch of the Pawtuxet River, as are necessary to provide its users with adequate and safe drinking water. A 1967 amendment to the Act designates communities and districts currently served and sets a maximum limit of a monthly average of 150 gallons per capita per day on the quantity of water to be supplied to each community or district. The board is also empowered to construct facilities, set rates, determine billing methods, lease its lands, set rules and regulations for users of the system, and regulate the amount and use of water in times of emergency.

(3) Operations. Currently, the Providence Water Supply Board supplies five communities on a retail basis and six water systems on a wholesale basis.

(4) Finance. Major construction projects are financed by bonds issued by the city of Providence. Operation and maintenance costs are covered by water use charges.

2. Regional Planning Agencies

In Rhode Island, the Statewide Planning Program, a state agency, conduct locally oriented planning and is involved in 208 planning. Today, the major responsibility in the area of water supply is the review of water supply projects where Federal programs of assistance to local communities require regional planning agency review prior to approval.

C. State Agencies

1. Department of Environmental Management (DEM)

The Department of Environmental Management in Rhode Island is involved with all key environmental issues which affect the State. The DEM has wide ranging jurisdiction encompassing protection, regulation and management of air, land and water resources in Rhode Island. The major activities of DEM are:

- . control and abatement of sources of water pollution.
- . improvement and preservation of air quality.
- . preservation of Rhode Island's lands, especially wetlands from pollution and unnecessary encroachment.
- . administration of Rhode Island's forest resources and natural areas.
- . operation and maintenance of State parks and beaches as well as protection of Rhode Island's natural resources and all visitors to State recreation areas.
- . preservation and management of Rhode Island's fish and wildlife resources.
- . enforcement of boating laws throughout the state while promoting safe boating practices.
- . development and improvement of the state's navigable waters and coastal zone.

2. Water Resources Board

The Rhode Island Water Resources Board was created in 1967 to coordinate the development, conservation, and apportionment of water resources in the State. The Board consists of nine members as follows:

- . five representatives of the public who are appointed by the Governor. At least two of these members shall be affiliated with public water systems.
- . the Director of the Department of Natural Resources.
- . the Director of the Department of Community Affairs.
- . the Chairman of the joint legislative committee on water resources.

The representatives of the state government all serve ex officio. The major powers and duties of the Board are:

- . to acquire sites and other related property, other than property already owned by an agency for water supply purposes, for reservoirs by either purchase or eminent domain.
- . to construct or purchase water supply facilities and lease these facilities to a public agency willing to construct and administer such facilities.
- . to formulate and maintain a long-range water resources guide plan and implementation program.
- . to provide for cooperative development, conservation, and use of water resources by water systems.

As part of its coordination responsibilities, the Water Resources Board has the power to allocate water resources, review and approve all new water supply sources and facilities, and insist that certain supply systems provide transmission lines to communities that may later need water from the source being developed. As for funding, the Board does maintain a water development fund. This fund is a special revolving fund established from rents on reservoir sites and other income from the sale of properties on sites to make loans to public water agencies for all projects related to water resources with the exception of the purchase of reservoir sites.

The purchase of reservoir sites requires the approval of the issuance of general obligation bonds by the General Assembly and the electorate. The Water Resources Board is not empowered to issue revenue bonds, which require no public or legislative consent.

3. Department of Health

The Rhode Island Department of Health has the power to approve the quality and adequacy of water supply sources and treatment works, set water quality standards, and enforce rules and regulations established by the Department.

4. Public Utilities Commission

The Public Utilities Commission's major responsibilities for water supply are to hold hearings and make decisions on requests for rate changes. It also decides on requests for variances from its minimum and maximum service connection pressure regulations of 20 psi and 120 psi gage pressure, respectively. It does not yet have jurisdiction over a few of the small private water companies in the State.

5. Rhode Island Statewide Planning Program

The Statewide Planning Program is a division of the Rhode Island Department of Administration. It is the central planning agency of the state and is guided by the state planning council, comprised of State, Federal and local representatives. Its function is to plan the development of the state, coordinate activities of government agencies and private individuals and groups, and provide planning assistance to the state government, the General Assembly, and government agencies.

6. The General Assembly

The Rhode Island General Assembly approves all local requests for development of water supplies outside of local jurisdiction and for diversions out of watersheds.

D. Federal Agencies

1. The U.S. Environmental Protection Agency (EPA)

Under provisions of the Safe Drinking-Water Act of 1974, the U.S. Environmental Protection Agency has the primary responsibility for establishing and enforcing drinking water standards and otherwise supervising public water supply systems and sources of drinking water. Interim primary drinking-water standards have been established by EPA and became effective 24 June 1977.

It is the intent of the Act to transfer the EPA's enforcement responsibilities for protecting drinking water to the states. To assume this responsibility, states must have drinking-water regulations no less stringent than the Federal regulations as prescribed in the Act and should have a plan for providing safe drinking water in emergency situations. They must also have monitoring programs that comply with Federal requirements and sufficient enforcement authority.

EPA is currently working with the states to assist them in the development of laws and regulations necessary to carry out their enforcement responsibilities. Whenever a state does not force a public water system's compliance with drinking water regulations or a schedule imposed with a variance or exemption, EPA is directed to begin enforcement action.

EPA also has the responsibility of developing requirements for underground injection control. Primary responsibility for carrying out these requirements falls to the states where underground source protection programs are designated to be needed. If the state fails to assume such a program within a specified period of time, EPA is required to prescribe a control program for that state.

2. U.S. Army Corps of Engineers

The Corps is involved in various aspects of water supply planning and development.

The Water Supply Act of 1958 authorized the Corps to provide for excess capacity for municipal and industrial water supply in reservoirs to be constructed primarily for other purposes on condition that non-Federal interests agree to pay the cost allocable to such water.

Title I of the 1965 Flood Control Act authorized the Corps to undertake the Northeast Water Supply Study (NEWS). The purpose of this study was to prepare a regional water supply plan that would address the long range water supply needs of the northeastern United States. This study was scheduled for completion in FY 1977. The study proposed single purpose water supply projects; the costs of these projects are to be reimbursed by non-Federal interests under the same conditions stipulated in the Water Supply Act of 1958.

3. Soil Conservation Service

The Soil Conservation Service of the Department of Agriculture is a technical agency created to develop and carry out a national soil and water conservation program, including the provision of technical aid for planning and installing conservation farming systems on farm lands, and for projects for the conservation and development of land and water resources in the upstream watersheds. This assistance is currently being provided primarily under three authorities: 1) the Soil Conservation Act of 1935, 2) the Flood Control Act of 1944, and 3) the Watershed Protection and Flood Prevention Act of 1954.

4. The Water Resources Council

The Water Resources Council was established by the Water Resources Planning Act of 1965 to encourage conservation, development and utilization of water and related land resources on a comprehensive coordinated basis.

5. Other Federal Agencies

As previously mentioned, the Department of Housing and Urban Development (HUD), the Farmer's Home Administration (FHA), the Economic Development Administration (EDA), and the Bureau of Reclamation administer programs which provide assistance to communities for the development of water supply systems.

II. EXISTING LEGAL FRAMEWORK

A. Water Rights

In Rhode Island, each town's rights are defined by special Acts of the State Legislature. Since cities and towns are chartered by the state, their rights are subject to the state's wishes. This means the state can pre-empt rights to various water bodies (including groundwater) or give one community the complete authority over a body of water lying in another community. The water body may not be jointly used by another public water supplier without the permission of the first user.

Public suppliers must petition the state for new sources and petitions may be challenged by other suppliers. Such conflicts are resolved by state legislation.

The State of Rhode Island has exercised its power to pre-empt water rights. Chapter 1278 of the Rhode Island General Laws grants the Providence Water Supply Board rights to waters of the North Branch of the Pawtuxet River and waters flowing into the Scituate Reservoir complex provided that the city shall forever discharge from its reservoir sufficient quantities of water to maintain a flow of not less than 500,000 gallons per day in the North Branch of the Pawtuxet River

below the lowest dam built by the city on the Branch. The Act also provides that the city shall discharge further quantities of water, when necessary, to maintain a flow of not less than 6 million gallons each day, except Sunday, into a pond formed by Arkwright Dam of Interlaken Mills in Coventry and to maintain a flow of not exceeding 72 million gallons each week at the Clyde Bleachery and Print Works in West Warwick.

Apart from water rights granted by Special Acts, water rights are determined by the doctrine of "riparian rights of reasonable use:" a landowner is entitled to make reasonable use of water flowing on his land or contiguous to it. The doctrine of riparian rights is a common law doctrine which has evolved over time through judicial decisions.

B. Protection of Water Supply

In Rhode Island, various enabling acts give municipalities the power to take by eminent domain, lands needed to protect a watershed or to collect and store water.

In addition to their power of eminent domain, municipalities have, through wetlands legislation, the power to issue protective orders to restrict alterations of wetlands where sites are significant to water supply and, through zoning legislation, the authority to use zoning to protect areas important to water supply.

The Rhode Island Department of Health has the authority to take action to preserve the quality of water used as sources of public supplies.

III. INSTITUTIONAL ALTERNATIVES

This section discusses several alternative institutional structures for the management of water supply. These alternatives are not portrayed here in complete detail. Rather, it is the purpose of this presentation to outline alternative institutional frameworks upon which details can be built after alternatives for water supply have been formulated. Further, the alternatives described here are not meant to be mutually exclusive as certain characteristics of one alternative may be incorporated into a number of options and combinations of various alternatives may be required to address both short and long term needs. The institutional options discussed fall into five categories based on the level of government most responsible for the alternative's implementation. These categories are local, regional, state, interstate and federal.

A. Local Options

Publicly and privately owned water utilities shall continue to provide water supply services on a local basis within the framework of each state's existing laws, regulations, and institutional arrangements. Individual communities or supply systems would be responsible for planning, financing, construction, and operation of their own water supply facilities. They would have powers of eminent domain, they would be responsible for setting rates and managing their water system by their own choice of administrative arrangements. State-level programs could be implemented to strengthen state responsibilities in the area of water supply management, however, these programs as now would cause minimum interference with local management responsibilities.

B. Regional Options

1. Single Purpose Regional District

a. Organization. Single purpose districts, similar to the Kent County Water Authority, could be established by special legislation which would assign specific responsibilities for water supply functions. Membership in these districts could be either voluntary or compulsory. They could be administered by an advisory board consisting of elected representatives from member municipalities could be based on equal representation of each municipality or proportional representation by population. The advisory board would be responsible for formulating policy, approving budgets, and employing personnel. It would appoint a board of trustees or water commissioners to provide daily management and supervision. Staff would consist of an executive director, an engineering section, an accounting section, and a legal advisor.

b. Powers. Each district would have the power of eminent domain. They would have the right to purchase all water rights and facilities of member municipalities with a guarantee to former owners of protection against future water shortages. All previous statutes concerning local water rights in the district would be repealed and former owners would receive equitable compensation for former property accredited to their account for services. These districts would also have the power to set rates, make rules and regulations for the operation of the system, make assessments against property owners for capital improvements and issue bonds.

c. Operational Features. Construction, operation and maintenance activities would be a district level responsibility. Planning, monitoring, and enforcement would also be carried out at a district level, but would be subject to state programs and standards. Daily service functions would be provided by the central district, or through a series of sub-districts. Billing for services would be accomplished by either retail or wholesale approach.

d. Finance. Special legislation would be required to allow districts to issue bonds pledging the full faith and credit of member municipalities as one separate entity. Thus, the debt limitation of each single municipality would not be affected. As previously stated, operation and maintenance costs would be provided through assessments against member municipalities or charges to individual users. Yearly budgets would be prepared by the board of trustees and approved by the advisory board.

2. A Multi-Purpose Regional District

Multi-purpose districts could be created by enabling legislation. These districts would have responsibility for water supply management along with responsibilities for other aspects of water and related land resources management. The organizational structure, operational procedures, powers and financing capabilities of these districts could be similar to those of the Single Purpose Regional District Alternative, however, water supply would be only one of the ongoing divisions or departments administered by the advisory board.

The outcome of the State's 208 plan is expected to determine the feasibility of the creation of regional districts with water supply and wastewater management responsibilities. In some areas, the recommended 208 management structure may conflict with the multi-purpose district structure discussed earlier.

C. State Options

1. A Single Purpose Statewide Agency

a. Organization. State agencies responsible for providing water supply services on a statewide basis could be established. These agencies could be administered by a single commissioner or a board of commissioners, responsible for day-to-day supervision. Services could be provided through a series of operating districts determined by the states.

b. Powers

These statewide agencies would have powers to:

- . formulate state water supply management plans.
- . construct, operate and maintain regional water supply facilities.
- . take water and lands by eminent domain for water supply services.
- . set rates for water supply services and wholesale water.
- . monitor all supply sources and facilities.
- . issue bonds.

Such agencies could also have the power to acquire existing local water supply systems or all existing local supplies could remain a local responsibility. However, local supplies would require state agency approval for all improvements and extensions.

c. Operations. Planning, financing and construction of new water supply projects would be carried on at the state level. District level offices would carry on day-to-day operation, maintenance, and monitoring functions for all water supply systems over which they have jurisdiction. These districts would also be responsible for billing users of the system.

Establishment and enforcement of rules and regulations for system operation and water quality standards would remain the responsibility of state agencies separate from these statewide water supply agencies, thus, allowing objectivity in enforcement actions.

d. Finance. These state water supply agencies could finance major construction projects through the state legislature as contingent debt. Debt would be repaid through assessments against municipalities benefiting. General obligation bonds could be issued pledging the full faith and credit of the state.

2. A Multi-Purpose Statewide Agency

State agencies with responsibility for providing water supply services in combination with services in other water and related land resources areas could be established. Organization powers

operation and financing capabilities of these agencies would be similar to that of the single purpose statewide agency described above. At the state level, the agency would be departmentalized into the various areas of water resource management over which it has jurisdiction.

D. Interstate Options

1. A Single Purpose River Basin Commission

a. Organization. In areas where river basins encompass more than one state, a river basin commission, responsible for water supply management could be established. Establishment of such an institution would require special legislation by participating states and interstate agreements. The commission could be administered by a board of commissioners consisting of members appointed by the governors of each state.

b. Powers. The commission could be empowered with various combinations of the following responsibilities.

- . resolution of problems of water rights and interstate allocation and diversion of water.
- . development of basin-wide water supply management plans.
- . review and approval of all projects with impacts on the basin's water supply.
- . finance, construct and operate new large-scale interstate water supply projects.
- . development of cost sharing arrangements and assumption of reimbursement obligations if projects are federally funded.

c. Operations. Existing local water supply agencies would continue to operate as they do today, however, new projects would be subject to review and approval of the basin commission.

If vested with powers to construct and maintain interstate water supply systems, the river basin commission would be responsible for operation of new interstate systems, and they would have the power to set rates for water use and bill water users.

d. Finance. Major construction projects could be financed through the issuance of revenue bonds, the revenue obtained from user charges, earmarked taxes levied by state or local governments, and federal loans. Day-to-day operation and maintenance of interstate water systems managed by the commission could be financed through user charges.

2. A Multi-Purpose River Basin Commission

A river basin commission with responsibilities for water supply management and various other aspects of water and related land resources management could be established by special legislation in participating states and interstate agreements. The commission could be organized much the same as a single purpose river basin commission except that it would be departmentalized according to its various water resources management responsibilities. Powers, operations and financing mechanisms would also be similar to those of the single purpose entity, however, the commission's multi-purpose functions would require a more intricate structure of interstate agreements.

E. Federal Options

The history of federal involvement in water supply management has been limited; most direct federal involvement in this area has consisted of construction projects for flood control and reclamation purposes with water supply components fully reimbursable by states and localities to be served. Indirect involvement has consisted of a grant and loan program for water supply planning, the preparation of water supply plans in conjunction with state and local entities, the setting of drinking water regulations, technical assistance, and research.

The Water Supply Act of 1958 clearly stated that it is the policy of the federal government to recognize the primary responsibility of state and local interests in the development of water supply for domestic municipal, industrial, and other purposes, and that the federal government should cooperate with states and local interests in the development of water supplies in connection with federal navigation flood control, irrigation of multi purpose projects, The Rivers and Harbors Act of 1965, which authorized the NEWS Study, places greater emphasis on a direct federal role in planning and possibly construction and management of water supply systems. However, the feasibility of federal takeover of water supply and distribution functions is quite low due to the heterogeneity of sources, requirements, and existing institutions and local preference for home rule.

Therefore, future options for federal participation in water supply management consist of limited direct roles and indirect or simulatory roles.

Direct federal participation could consist of federal provision of water supply facilities to supplement existing systems. Either a federal corporation could be established to finance, construct and possibly manage these facilities, or an existing federal line agency could assume one or more of these functions.

Indirect federal options could consist of:

- . federal assistance in resolution of water allocation problems.
- . increased federal participation in water supply planning through membership in various interstate and state water resources planning agencies.
- . stronger federal programs to provide funds and technical assistance for state and local planning. Such programs could provide non-reimbursable grants for demonstration projects.
- . establishment of a federal agency to coordinate applications for water supply grant and loans programs.
- . federal establishment of research institutes to study new technologies, water conservation techniques, store data, and disseminate information.
- . formation of a permanent federal agency, provide technical assistance to state and local interests in areas of planning and design and project evaluation.

Several of the above options could be implemented, along with the various local, state, and interstate alternatives discussed here to provide better integration of water supply planning and management between federal and non-federal agencies.